

US EPA ARCHIVE DOCUMENT

TABLE C-1-3

COPC INTAKE FROM BEEF, MILK, PORK, POULTRY, AND EGGS

(Page 1 of 4)

Description			
<p>This equation calculates the daily intake of COPCs from the ingestion of animal tissue (where the i in the equation refers to beef, milk, pork, poultry, or eggs). The consumption rate varies for children and adults and for the type of animal tissue (j). The concentration in the animal tissue will also vary with each scenario location.</p> <p>Consumption rates were derived from the <i>Exposure Factors Handbook</i> (U.S. EPA 1997). U.S. EPA (1997) presents consumption rates based on body weight; therefore, body weight is not included as a variable in the calculation of I_i.</p> <p>Uncertainties associated with this equation include the following:</p> <ol style="list-style-type: none"> (1) The amount of animal tissue intake is assumed to be constant and representative of the exposed population. This assumption may under- or overestimate I_i. (2) The standard assumptions regarding period exposed may not be representative of any actual exposure situation. This assumption may under- or overestimate I_i. 			
Equation			
$I_i = A_i \cdot CR_i \cdot F_i$			
Variable	Description	Units	Value
I_i	Daily intake of COPC i from animal j tissue	mg/kg-day	
A_j	Concentration of COPC i in animal tissue j	mg/kg FW	<p>Varies</p> <p>This variable is COPC- and site-specific, and is calculated by using the equations in Tables B-3-10, B-3-11, B-3-12, B-3-13, and B-3-14.</p> <p>Uncertainties associated with this variable include the following:</p> <ol style="list-style-type: none"> (1) Based on the information provided, A_{beef} and A_{pork} are dependent on the concentrations of COPCs estimated in plant feeds and soil, and the biotransfer factors estimated for each constituent. To the extent the estimated concentrations in plants and the biotransfer factors do not reflect site-specific on local conditions, A_{beef} may be under- or overestimated. (2) Uptake of COPCs into chicken and eggs has typically been applied only to PCDDs and PCDFs but could possibly be used to calculate A_{chick} and A_{egg} resulting from other COPCs. (3) The assumption that 10 percent of a chicken's diet is soil may not represent site-specific or local conditions of chickens raised on subsistence farms. Stephens, Petreas, and Hayward (1992) and Stephens, Petreas, and Hayward (1995) suggest the percentage of soil in the diet of chickens raised under field conditions may be greater than 10 percent. Therefore, the concentration of COPCs in eggs, A_{egg}, and the concentration of COPCs in chicken, A_{chick}, may be underestimated.

TABLE C-1-3

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(Page 2 of 4)

Variable	Description	Units	Value																		
CR_j	Consumption rate of animal tissue j	kg/kg-day FW	<div>Varies</div> <div>This variable is site-specific. U.S. EPA OSW recommends the ingestion rates of animal tissues (see the equation in Table C-1-4 for fish ingestion). The recommended ingestion rates for homegrown beef, milk, poultry, eggs, and pork have been derived from U.S. EPA (1997):</div> <div>Animal Tissue Ingestion Rates (kg/kg-day FW)</div> <table><thead><tr><th></th><th><u>Adult</u></th><th><u>Child</u></th></tr></thead><tbody><tr><td>Homegrown Beef</td><td>0.00114</td><td>0.00051</td></tr><tr><td>Homegrown Milk</td><td>0.00842</td><td>0.01857</td></tr><tr><td>Homegrown Poultry</td><td>0.00061</td><td>0.000425</td></tr><tr><td>Homegrown Eggs</td><td>0.00062</td><td>0.000438</td></tr><tr><td>Homegrown Pork</td><td>0.00053</td><td>0.000398</td></tr></tbody></table> <div>Ingestion rates were determined from U.S. EPA (1997) Tables 13-28, 13-36, 13-43, 43-54, and 13-55. The ingestion rates listed in U.S. EPA (1997) were derived from the 1987-1988 USDA National Food Consumption Survey and may be used to assess exposure to contaminants in foods grown, raised, or caught at a specific site. Prior to the adjustment for cooking and preparation loss, the mean individual meat consumption rates were weighted by age group. The ingestion rates were then adjusted for cooking and preparation loss as recommended in U.S. EPA (1997). The total preparation and cooking loss was in the range of 45 to 54 percent for beef, pork, and poultry.</div> <div>In addition, ingestion rates for the child receptor represent a time-weighted mean from the respective tables. Where data for a specific age group was incomplete, the intake was extrapolated using data from the general population (Tables 11-11 and 11-13 of U.S. EPA 1997). Specifically, an age-group home produced item intake was derived by multiplying the total mean intake for that home produced item by the ratio of the item- and age-group general population intake rate (Tables 11-11 and 11-13 of U.S. EPA 1997) to a total individual general population intake rate for that item (Tables 11-11 and 11-13 of U.S. EPA 1997). For example:</div> <div>Child (01-02) home produced = 2.45 g/kg-day (Table 13-36) x <u>10 g/day (Table 11-11)</u> beef intake rate </div>		<u>Adult</u>	<u>Child</u>	Homegrown Beef	0.00114	0.00051	Homegrown Milk	0.00842	0.01857	Homegrown Poultry	0.00061	0.000425	Homegrown Eggs	0.00062	0.000438	Homegrown Pork	0.00053	0.000398
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TABLE C-1-3

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(Page 3 of 4)

Variable	Description	Units	Value
CR_j <i>continued</i>	Consumption rate of animal tissue j	kg/kg-day FW	<p>For the metals mercury, selenium, and cadmium, the concentration in beef, milk, and pork, and the consumption rate are in kilograms dry weight per day. Wet-weight to dry-weight conversion information for beef, milk, and pork is presented in U.S. EPA (1997)</p> <p>The following uncertainty is associated with this variable:</p> <p>The recommended tissue-specific consumption rates may not accurately reflect site-specific in local conditions. As a result, tissue-specific intakes may be over- or underestimated.</p>
F_j	Fraction of animal tissue j that is contaminated	unitless	<p>1.0</p> <p>This variable is site-specific. U.S. EPA OSW recommends an F_j of 1.0 for all animal tissues consumed. This recommendation is consistent with NC DEHNR (1997).</p> <p>The following uncertainty is associated with this variable:</p> <p>The fraction of animal tissue that is contaminated is site-specific; therefore, any of the following may be under- or overestimated: variations in the proximity of the receptor to the contaminated source, size of the contaminated source, receptors of concern, mobility of receptors, and nature of exposure.</p>

TABLE C-1-3

COPC INTAKE FROM BEEF, MILK, PORK, POULTRY, AND EGGS

(Page 4 of 4)

REFERENCE AND DISCUSSIONS

Stephens, R.D., M.X. Petreas, and D.G. Hayward. 1992. "Biotransfer and Bioaccumulation of Dioxins and Dibenzofurans from Soil." Hazardous Materials Laboratory, California Department of Health Services. Berkeley, California. Presented at the 12th International Symposium on Dioxins and Related Compounds. August 24 through 28. University of Tampere, Tampere, Finland.

This document is cited as the source of the assumption that free-range chickens ingest soil as 10 percent of their diet and as the source of the dioxin and furan congeners-specific *BCFs* recommended by NC DEHNR (1997). However this document does not clearly reference or document the assumption that soil represents 10 percent of a free-range chicken's diet. The document appears to cite two other documents as supporting its assumption: (1) Chang, Hayward, Goldman, Harnly, Flattery and Stephens (1989) and (2) Petreas, Goldman, Hayward, Chang, Flattery, Wiesmuller, Stephens, Fry, and Rappe (1992).

Also, this document presents dioxin and furan congener-specific *BCFs* (thigh) for the low- exposure group after 80 days of a 178-day total exposure period. The chickens in the low-dose group were fed a diet containing 10 percent soil with a PCDD/PCDF concentration of 42 ppt I-TEQ. Chickens in the high-dose group were fed a diet containing 10 percent soil with a PCDD/PCDF concentration of 458 ppt I-TEQ; *BCF* results were not presented from the high-dose group.

Stephens, R.D., M.X. Petreas, and D.G. Hayward. 1995. "Biotransfer and Bioaccumulation of Dioxins and Furans from Soil: Chickens as a Model for Foraging Animals." *The Science of the Total Environment*. Volume 175: 253-273.

This document is an expansion of the results originally presented in Stephens, Petreas, and Hayward (1992). In particular, this document suggests that the percentage of soil in the diet of chickens raised under field conditions is likely to be greater than 10 percent, the value that was used in the experimental study presented in this document.

Also, this document presents dioxin and furan congener-specific *BCFs* (thigh) under two exposure schemes; low exposure and high exposure. The white leghorn (Babcock D 300) chickens in the low group were fed a diet containing 10 percent soil with a PCDD/PCDF concentrations of 42 ppt I-TEQ. Chickens in the high group were fed a diet containing 10 percent soil with a PCDD/PCDF concentration of 460 ppt I-TEQ (some congeners were fortified by spiking).

The *BCFs* presented for low- and high-dose groups both represent averages of results from Day-80 and Day-164 of a total 178-day exposure period.

U.S. EPA. 1997. *Exposure Factors Handbook*. Office of Research and Development. EPA/600/P-95/002F. August.

This document is the source for home produced beef, milk, pork, poultry, and egg consumption rates.